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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/816,958	04/05/2004	Yukio Takigawa	042323	2429

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EXAMINER	
LE, DUNG ANH	

ART UNIT	PAPER NUMBER
2818	

DATE MAILED: 04/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/816,958	TAKIGAWA ET AL.	
	Examiner	Art Unit	
	DUNG A. LE	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 March 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 April 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

DLe

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

In response to Amendment dated 3/21,2006, Previous office action has been withdrawn.

Claim Rejections

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 3, 7, 9,11, 13 and 15 are rejected under 35 USC 102 (b) as being anticipated by Ngo et al. (6472755 B1).

Ngo et al. teach a method for fabricating a semiconductor device comprising the steps of:

forming an opening in an insulation film 20 [figs. 2- 4 and related texts];

forming an interconnection layer of Cu 23 as a main material in the opening [0004]; and

concurrently spraying nitrogen gas and water on the surface of the interconnection layer buried in the opening [col 6, lines 25- 45].

Regarding claim 2, Ngo the step of forming a diffusion preventing film 50 for preventing the diffusion of the Cu on the insulation film and the interconnection layer.

Regarding claim 3, Ngo teaches the claimed invention as applied to claims 1-2 including the diffusion preventing film is an SiC film or a silicon nitride film (Ngo, col 6, line 48-55).

Regarding claim 7, Ngo teaches the claimed invention as applied to claims 1 including the step of forming the opening, the opening containing a via hole and an interconnection trench formed in a region containing the via hole is formed [figs. 2-3].

Regarding claim 8, Ngo teaches the claimed invention as applied to claims 1-2 including the step of forming the opening, the opening containing a via hole and an interconnection trench formed in a region containing the via hole is formed (Figs. 2-3).

Regarding claim 9, in the step of forming the opening, the opening containing a via hole and an interconnection trench formed in a region containing the via hole is formed (figs. 2-3)

Regarding claim 11, Ngo discloses the claimed invention as applied to claim 1 including the water to be concurrently injected with the nitrogen gas is carbonated water or ozonized water (col 7, lines 5-10).

Regarding claim 12, Ngo discloses the claimed invention as applied to claims 1-2 including the water to be concurrently injected with the nitrogen gas is carbonated water or ozonized water (col 7, lines 5-10) .

Regarding claim 13, Ngo disclose the claimed invention as applied to claims 1, 2 and 3, except for the water to be concurrently injected with the nitrogen gas is carbonated water or ozonized water (col 7, lines 5-10).

Regarding claim 15, Ngo disclose the claimed invention as applied to claims 1 and 7 and the water to be concurrently injected with the nitrogen gas is carbonated water or ozonized water (col 5, lines 40- 45).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5- 6 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Ngo et al. (6472755) and in view of Li et al. (2004/0219795 A1).

Regarding claim 5, Ngo et al. discloses the claimed invention as applied to claims 1- 2, except for the step of applying hydrogen plasmas to the surface of the insulation film and the surface of the interconnection layer.

Li et al. teach the step of applying hydrogen plasmas 38 to the surface of the insulation film 28 and the surface of the interconnection layer 36 (fig. 3, [0053]) .

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to applying hydrogen plasmas 38 to the surface of the insulation film and the surface of the interconnection layer in Ngo 's method, in order to improve the performance of the low-k dielectric in or over which the copper interconnect has been created by increasing the breakdown voltage of the low-k dielectric, resulting in improved Time Dependent Dielectric Breakdown (TDDB), removed the layer of CuO or Cu.sub.2O from the surface of a created copper interconnect, reduced the dielectric constant of the low-k dielectric in or over which the copper interconnect has been created by removing carbon from the low-k dielectric and by thereby making the low-k dielectric more porous, and prevented damage to the surface of the low-k dielectric in or over which the copper interconnect has been created. ([0055]-[0058]).

Regarding claim 6, Ngo et al. disclose the claimed invention as applied to claims 1-2, and 3 except for the step of applying hydrogen plasmas to the surface of the insulation film and the surface of the interconnection layer.

Li et al. teach the step of applying hydrogen plasmas 38 to the surface of the insulation film 28 and the surface of the interconnection layer 36 (fig. 3, [0053]) .

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to applying hydrogen plasmas 38 to the surface of the insulation film and the surface of the interconnection layer in Ngo 's method, in order to improve the performance of the low-k dielectric in or over which the copper interconnect has been created by increasing the breakdown voltage of the low-k dielectric, resulting in improved Time Dependent Dielectric Breakdown (TDDB), removed the layer of CuO or Cu.sub.2O from the surface of a created copper interconnect, reduced the dielectric constant of the low-k dielectric in or over which the copper interconnect has been created by removing carbon from the low-k dielectric and by thereby making the low-k dielectric more porous, and prevented damage to the surface of the low-k dielectric in or over which the copper interconnect has been created. ([0055]-[0058]).

Claims 4, 10 and 14 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Ngo et al. (6472755 B1) in view of Li et al. (2004/0219795 A1).

Regarding claim 4, Ngo et al. disclose the claimed invention as applied to claim 1, except for the step of applying hydrogen plasmas to the surface of the insulation film and the surface of the interconnection layer.

Li et al. teach the step of applying hydrogen plasmas 38 to the surface of the insulation film 28 and the surface of the interconnection layer 36 (fig. 3, [0053]) .

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to applying hydrogen plasmas 38 to the surface of the insulation film and the surface of the interconnection layer in Ngo 's method, in order to improve the performance of the low-k dielectric in or over which the copper interconnect has been created by increasing the breakdown voltage of the low-k dielectric, resulting in improved Time Dependent Dielectric Breakdown (TDDB), removed the layer of CuO or Cu.sub.2O from the surface of a created copper interconnect, reduced the dielectric constant of the low-k dielectric in or over which the copper interconnect has been created by removing carbon from the low-k dielectric and by thereby making the low-k dielectric more porous, and prevented damage to the surface of the low-k dielectric in or over which the copper interconnect has been created. ([0055]-[0058]).

Regarding claim 10, Ngo et al and Li discloses the claimed invention as applied to claims 1 and 4 including the step of forming the opening, the opening containing a via hole and an interconnection trench formed in a region containing the via hole is formed (Ngo, figs 2-3).

Regarding claim 14. Ngo in view of Li discloses the claimed invention as applied to claims 1 and 4, including the water to be concurrently injected with the nitrogen gas is carbonated water or ozonized water (Ngo, col 7, lines 5-10).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dung A. Le whose telephone number is (571) 272-1784. The examiner can normally be reached on Monday-Tuesday and Thursday 6:00am- 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on (571) 272-1787. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DUNG A. LE
Primary Examiner
Art Unit 2818